

MICROBIAL CONTROL OF HYDROGEN SULFIDE PRODUCTION

Michael J. McInerney
Vishvesh K. Bhupathiraju
Department of Botany and Microbiology
University of Oklahoma
770 Van Vleet Oval
Norman, OK 73019

Kerry L. Sublette
Center for Environmental Research and Technology
University of Tulsa
600 S. College Ave.
Tulsa, OK 74104

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INTRODUCTION

Microbial Souring of Oil and Gas Reservoirs

Hydrogen sulfide is a toxic and corrosive gas that greatly increases the cost of recovery of oil and natural gas. A major mechanism for hydrogen sulfide production in petroleum/gas reservoirs below 80°C is microbial sulfide production [1]. Because of their diverse metabolic properties and widespread occurrence, sulfate-reducing bacteria were once thought to be only microorganisms responsible for microbially induced souring. However, sulfate reducers are not the only organisms found in oil/gas reservoirs that produce sulfide [2]. In fact, the most commonly detected sulfide-producing bacteria (such as *Shewanella putrefaciens*) do not use sulfate as an electron acceptor, but use other sulfur oxyanions. Thus, methods to detect or control souring based solely to the detection or control of sulfate-reducing bacteria may not be effective in actual field situations.

The detrimental activities of sulfide-producing bacteria can be controlled by the effective use of biocides. This type of remediation strategy is most successful in controlling unwanted activities in surface facilities. However, the control of these activities in the reservoir through the use of biocides is often difficult and expensive. Our approach is to manipulate the ecology of the system so that the terminal electron-accepting process is changed from sulfate reduction to nitrate reduction. Thus, even if sulfate reducers are present in the reservoir, the accumulation of the unwanted product of their metabolism, sulfide, is prevented. This is done by the addition of specialized strain of *Thiobacillus denitrificans* that can oxidize sulfide to sulfate by reducing nitrate to nitrogen gas.

Thiobacillus denitrificans

Thiobacillus denitrificans is an obligate autotroph and facultative anaerobe which can utilize reduced sulfur compounds as energy sources and oxidize them to sulfate. Under anaerobic conditions, nitrate is used as a terminal electron acceptor and is reduced to elemental nitrogen. Sublette and Sylvester [3-5] and Sublette [6] have demonstrated